

## CLAIMS

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1/ An electromagnetic device, that is a linear or rotary single- or multi-phase motor or generator, comprising, for each phase, at least two relatively-movable sets of teeth made of soft magnetic material, one set of teeth being associated with the stator and the other with the rotor, the device being of a size enabling it to generate a maximum magnetic potential  $U_{\max}$  of about  $1.7 \times 10^{-4} J / \mu_0$  ampere turns (At), and being characterized in that the width E of the minimum air-gap between teeth of the rotor and of the stator as measured in the direction perpendicular to their degree of freedom is approximately equal to or greater than:

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the value

$$0.7[1 - 5 \times 10^{-4}(U_{\max} - 1.7 \times 10^{-4} J / \mu_0)] \mu_0 U_{\max} / J$$

when

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$$[1 - 5 \times 10^{-4}(U_{\max} - 1.7 \times 10^{-4} J / \mu_0)] \geq 0.5$$

or the value  $0.35 \mu_0 U_{\max} / J$

when

$$[1 - 5 \times 10^{-4}(U_{\max} - 1.7 \times 10^{-4} J / \mu_0)] < 0.5$$

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or that E is greater than  $2 \times 10^{-3}$  m;

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where  $\mu_0$  is the permeability of a vacuum,  $U_{\max}$  is the maximum generated magnetic potential difference for causing the magnetic field to pass through the air-gap E, said potential difference being due either solely to the ampere-turns of the coil(s) feeding the air-gap E, or to the sum of said ampere-turns plus the magnetic potential difference between the two sets of teeth in the absence of currents due to a permanent magnet, and where J is the maximum polarization of the soft magnetic material used for making the teeth.

2/ A device according to claim 1, characterized in that the width E of the air-gap is smaller than or approximately equal to the value  $1.1\mu_0 U_{\max}/J$ .

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3/ A device according to any preceding claim, characterized in that the width E of the air-gap is greater than  $1.2 \times 10^{-4}$  m.

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4/ A device according to any preceding claim, characterized in that the width E of the air-gap is greater than  $1.5 \times 10^{-4}$  m.

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5/ A device according to any preceding claim, characterized in that hollows (22, 22") between the rotor teeth are essentially of parabolic shape.

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6/ A device according to any preceding claim, characterized in that hollows (21) between the teeth of the stator are essentially of parabolic shape.

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7/ A device according to claim 5 or claim 6, characterized in that the angle  $\beta$  formed between the tangents to the profile of the teeth on the corners thereof has a value lying in the range  $95^\circ$  to  $120^\circ$ .

8/ A device according to claim 7, characterized in that the angle  $\beta$  has a value lying in the range  $100^\circ$  to  $115^\circ$ .

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9/ A device according to any preceding claim, characterized in that the pole pieces of the stator (12) are uniform in length in the axial direction, and uniform in width in a radial plane, and in that the coils (5) are prefabricated coils on insulating supports (15), said coils and pole pieces of the stator being arranged in such a manner as to enable the prefabricated coils to be put into place on said stator pole pieces.

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10/ A device according to any preceding claim,  
characterized in that the device is a hybrid motor  
comprising a permanent magnet (10) delivering magnetic  
5 potential so that the total magnetic potential difference  
at the terminals of the air-gap is substantially equal to  
 $0.5U_{\max}$ .

11/ A device according to claim 10, characterized in that  
10 the rotor (2) is generally cylindrical in shape being  
constituted by at least one assembly in axial alignment  
comprising the permanent magnet (10) in the form of an  
axially-magnetized annular disk, and two magnetically-  
permeable rotor pole pieces (6, 7) disposed on either  
15 side of said disk.

12/ A device according to any one of claims 1 to 9,  
characterized in that the device is a variable reluctance  
motor or generator.

20 13/ A device according to claim 12, characterized in that  
an end (28) of a stator pole piece (12") is curved with a  
radius such that, when the teeth of the stator and the  
rotor are facing each other, the air-gap between them is  
25 of varying width.

14/ A device according to any preceding claim,  
characterized in that the air-gap width  $E$  is greater than  
or essentially equal to the value  $0.7\mu_0 U_{\max}/J$ .

30 15/ A device according to claim 14, characterized in that  
the air-gap width  $E$  is greater than or essentially equal  
to  $0.8\mu_0 U_{\max}/J$ .